

THE ANNALS

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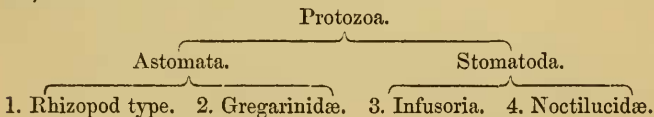
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XXVII.—*Outline of a Scheme of Classification of the Invertebrata, founded upon the Progressive-Development Theory.*
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ON studying the leading members of the Protozoa with the view of discovering, if possible, their nearest descendants, the whole subkingdom of Invertebrate animals arranged itself, apparently quite naturally, into as many groups as there were points of origin. In unfolding the results of this investigation, which must, of course, be more or less speculative, Prof. Huxley's arrangement of the Protozoa may be taken as a basis, thus—



The four groups numbered in the above table exhibit a marked increase in their vital activity and structural development in the order in which they stand; and although there is no reason to doubt that the last three may have been derived from the first, the upward evolutionary tendencies of all would appear to be quite distinct. Indeed each may be regarded as primordial in its own series, or the salient point of descent and divergences, which, however different *inter se*, may be referred to their own definite source.

1. Tracing from the Rhizopod type to the simple polyps, in fact, to the Coelenterata crowned with the Ctenophora, and from the latter through the Brachiopoda and Polyzoa to the

* Communicated by the Director General of the Medical Department of the Navy.

Tunicata, we finally enter the precincts of the Mollusca proper. This is, no doubt, the "royal road" to the Vertebrata, if, indeed, there be any; for it would be hopeless to seek for the evolution of this higher type through any of the other channels to be briefly noticed in this paper. The Insects, Crustaceans, and Echinoderms present impassable barriers in this respect. They are so curiously constructed, exhausting one's ideas of modification, or so perfect in their way as to preclude any conception of their further development; but the morphological resources of the Molluscan type would appear to be ample enough*.

2. The Gregarinidæ evidently hold a superior position to the other astomatous families of Protozoa; and it would appear as though the cestoid Entozoa were derived from them. In this connexion the sucker occurring in *Actinocephalus* and the circle of uncini like those of *Tenia* in *Hoplorhynchus* are very significant. Moreover the usually elongated body of these animals is invested with a more distinct tegumentary coat than that of the Rhizopoda. *Tetrarhynchus flaviceps* and such astomatous forms have probably led the way to the more highly organized Acanthocephala and the Nematoidea generally, to which may have succeeded the Trematoda.

3. Many Infusoria have been taken for the larvæ of Turbellaria, and *vice versâ*, giving some support to the view that the latter order of animals may have descended from the former. And further, if we compare the internal anatomy of *Arhynchia* or *Nemertes* with that of *Sipunculus*†, and study also the larval state of these animals, their close affinity will be made apparent; and if this be so, next must follow *Synapta*, *Holothuria*, in fact the Echinodermata as a whole, to

* A more detailed account of the morphological relations of the Molluscoida and Coelenterata will be found in a paper on this subject by the author, published in the 'Transactions of the Royal Society of Edinburgh,' 1864, vol. xxiii. part 3.

† I can confirm the statement of Krohn as to the existence of two supracosophageal ganglia in *Sipunculus*, with a bilateral distribution of nerves to the circle of simple and finely ciliated tentacula. Moreover I have found an unequivocal eye-speck in connexion with each ganglion. The ventral threads are plain and destitute of the series of ganglia occurring in the Hirudinea, to which group many naturalists refer the genus. The intestine passes backwards, winding round a suspensory tendinous cord, upon which it returns to the position of the dorsal anus; and the perivisceral membrane is richly ciliated, forming little mesenteries to inclose the intestinal vessels. In the coral-boring species the armature of the integument consists of pointed tuberculations over the middle and posterior regions of the body, and gradually approximating transverse rings of recurved hooks extending along the fore part to the base of the tentacula.

complete the series. Yet this arrangement would have the apparent effect of crowning the order with the Crinoidea, which, in the more common acceptation of the case, should hold the earliest position. But the theory of the evolution of new forms from preëxisting ones would be evidently defective if it did not admit of occasional retrogression in some points of organization as well as progression in others, and even often of considerable latitude of development of no certain significance in either direction.

4. *Noctiluca* has been chosen as the nucleus of the annulose and articulate series, and would seem to be linked with the Rotifera through such genera as *Asplanchna*, Gosse, and *Ascomorpha*, Perty. All things being considered, it is doubtful if a more satisfactory selection could be made from the domain of the Infusoria.

From the Rotifera, through the Annelida, we may trace the development of the crustaceous and chitinous types of Articulata like a dichotomous branch.

The Sagittidæ no doubt hold an important place between the Crustacea and the earlier annulose forms, in connexion with which view their articulated jaws and finely striped muscular fibres must be borne in mind.

The first rudiment of a tracheal system is probably to be sought for in the Terricolous Annelida; but it is doubtful if articulated limbs and a dorsal heart make their appearance earlier than amongst the Julidæ.

Finally, a representative relationship has long been recognized between the crustaceous Macrura, Anomura, and Brachyura and the chitinous Myriopoda, Insecta, and Arachnida; but however plausible the attempt may be to trace them back to a more simple origin, it is certain that we can form no conception of their further development.

I here subjoin a tabular scheme of the leading divisions and groups of the Invertebrata in accordance with the foregoing views.

Protozoa.			
Astomata.		Stomatoda.	
<i>Rhizopoda.</i>	<i>Gregarinidæ.</i>	<i>Infusoria.</i>	<i>Noctiluclidæ.</i>
Coelenterata.	Cestoidea.	Aprocta†.	Rotifera.
Molluscoidea.	Nematoidea*.	Proctucha†.	Annelida.
Mollusca proper.	Trematoda.	Echinodermata.	Articulata.

* Including Acanthocephala.

† Turbellaria.